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ABSTRACT

This report describes the underlying premises, operations and the pilot implementation of TICCIT (Time-Shared Interactive Computer-Controlled Information by Television) system which aims to facilitate instruction and learner control via the combined use of mini-computers and color television. TICCIT courseware is organized in a hierarchical structure and learners can control the pace, sequence, difficulty level, and presentation mode at the segment level of the learning task. At its developmental stage, TICCIT has demonstrated acceptable hardware reliability, and potentials in improving learners' achievement and attitudes toward learning. The system has also efficiently utilized the television medium to present information and examples in either expository or inquisitory mode. (SC)

TICCIT Project

presented by

Stephen J. Anderson

TICCIT

Welcome to TICCIT. TICCIT is an acronym standing for Time-Shared Interactive Computer-Controlled Information by Television. TICCIT is a system where as many as 128 computer terminals share time on a mini computer. The information is displayed on a standard color television receiver which has been interfaced with the computer. It is not only possible to display still graphic information for an unlimited time, but also video tape materials from a standard video cassette.

TICCIT is not a conventional CAI or CMI system. The system is a result of an interdisciplinary cross-fertilization of three institutions: the MITRE Corporation, the University of Texas CAI Laboratory and Brigham Young University. The project is based at BYU and is funded by the National Science Foundation (NSF). It is headed up by Dr. C. Victor Bunderson.

I'm going to focus on three areas: 1) some premises underlying the development of TICCIT, 2) how the system functions, and 3) some results of the pilot implementation of TICCIT.

Underlying Premises

TICCIT was born in a climate of innovation around the turn of the decade. Educators had experienced a flood of media hardware and technologies--television, CAI, CMI. Students were expressing displeasure over what seemed to them to be a manipulative control of their educational experience. Questions were being raised about the effectiveness of instruction--not only from media, but instructors as well. Perhaps these conditions influenced TICCIT developers to identify three premises to guide development: First, that the hardware and software (that is the computer logic) should be designed to meet the needs of instruction (referred to as courseware). In other words, they were not looking for a readymade hardware system to which they would have to adapt instruction. But they wanted to develop the instruction, then develop a hardware system which would facilitate the instruction.

Second, through their experience with computer uses in instruction, TICCIT developers recognized that in most instruction, whether classroom, TV, CAI or CMI, the learner had little control over his learning experience except to elect to go to class, flip a switch, or log on or off of a computer system. Once he was "logged on" the learner's instruction was programmed for him. It seemed to TICCIT developers, that the learner ought to have the control, especially with computers. He should manage the machine rather than have the machine manage him.

Third was to draw upon the principles discovered in instructional research and apply those that seem logical and viable.

Operation

TICCIT can be fully understood only by experiencing it personally. But let me attempt to describe the system; not from a technical or engineering point of view, but from a user point of view. I'd like to divide this part of the discussion into two areas--How the instruction is structured and the mechanics of operation.

Instructional Structure

TICCIT courseware is heirarchically organized into four levels. The course structure, unit structure, lesson structure, and learning segments.

For example, when a student logs on to a TICCIT course, the first display he sees is a course map showing the heirarchal structure of the units within that course. Each unit title is displayed and the student can select the one he wants to work with. He can also call up the course objective. Suppose the student options to select Unit 12, but he has not completed the prerequisite--Unit 11. He will probably get an advisor message suggesting he begin with Unit 11. (Each student's progress is stored in a memory.) However, he still has the option of going into Unit 12, if he desires.

The unit map shows the student what lessons are available and gives him access to the unit objective. When a lesson is selected, a lesson map is displayed. This tells the student what segments are contained in the lesson, and the lesson objective can be accessed. He can also get an introduction or overview to the lesson.

At this point, the student selects the segment he wants to learn. Entering the segment number results in a display of the segment objective.

It is at the segment level that the instruction takes place. Each segment consists of a number of information files (designated as rule files), also example files and practice files (the latter are diagnostic tests). Each set of files contains rules, examples or practice items at varying levels of difficulty. The student decides what difficulty level he wants, and can access any of these files as he likes. Some students may wish to begin with a practice. Others may wish to see the rule first then look at some examples before attempting the practice files. When the student has completed a sufficient number of practice items or if he feels he is ready, he may access the tests.

The course is completed by completing the lesson segments of each unit.

Mechanics of Operation

With TICCIT the management control talked about earlier is given to the student through his use of two control panels and a typewriter terminal.

The learner control panel, located to the right of the keyboard gives the student control to move as he desires through the course. The MAP key (center) is used to display a course, unit, or lesson map. At each of these levels he may access the objective by pressing the objective key (left center). If at any time the student has a question about procedure he can access a series of advisor files through the ADVICE key. The six buttons at the bottom of the panel are used when the student is working at the segment level. Through the bottom three he selects rule statements, examples or practice items. The keys marked HARD and EASY allow him to select examples and practice items of different difficulty levels. If he becomes stuck on a problem, he can get some "work through" help by pressing the HELP key. The top six keys allow the student to log on or off of the system, move forward or backward, skip tests and certain other operations, and write notes to the author or to other students.

The typewriter portion of the terminal is used to enter information to the computer. Math function symbols are overlaid so that mathematical problems can be solved.

The control panel on the right of the keyboard allows the student to edit his input. Through these keys the student can move the cursors to a desired point on the screen, and give the system editing commands.

At the present time, all basic courseware materials are displayed in still graphic form. Frames are accessed one at a time as in reading the pages of a book. But, as I mentioned earlier, video tape programs can also be displayed. When the desired tape has been selected, a printed message is sent to the video tape operation center. An operator loads the tape on a video cassette and starts the program which has been switched to the TV set.

Results

It should be pointed out that TICCIT is yet in a research and development phase. Pilot systems are operating at the Alexandria campus of Northern Virginia Community College, Phoenix College and at BYU. The main courses are mathematics and English. Systems have also been installed at the MITRE Corporation and the Naval Air Station at North Island, San Diego. Up to the present time the equivalent of nearly 2,000 students have taken math or English courses at Alexandria, Phoenix and BYU. Let's look at some results in terms of hardware reliability achievement and attitude, and contributions to the field of instruction. I would like to focus the latter more toward mediated instruction, since that's the field most represented here.

Hardware Reliability

We're all aware that Murphy's Law can easily run rampant in electronic media. In order to reduce this factor, the developers elected to build the system around "off the shelf," proven components rather than using innovative hardware. The MITRE Corporation in measuring the reliability of the systems in the field and reported BYU's system varied between 97% and 98% and the two colleges were at 99%. MITRE's report did not include time which the system was down for troubleshooting and for data recording work with the system following a failure. With these factors figured in, BYU reports 90% to 97% reliability, which is quite acceptable. Of course, this assumes a favorable operating environment for the computer equipment. Lack of proper cooling and dust control will adversely affect reliability.

Achievement and Attitudes

In a Technical Report on TICCIT, dated September 1973, Bunderson outlined five student achievement and attitude goals which should be achieved through the TICCIT system:

1. At least 85% of the students who take the TICCIT courses will achieve mastery, as defined by the mastery tests at the lesson and unit levels.

2. Students will improve their learning efficiency by at least 25% as measured between the first two and the last two units of any course.

3. Learning strategies--that is how students use the learner-control commands described earlier--will improve. This goal is measured by the extent to which efficiency improves simultaneously with a reduction in the number of times a student asks for or requires advice.

4. Students will achieve a positive approach relative to the subject matter in any TICCIT course.

5. Students' attitude of responsibility toward learning will increase from the first unit to the last unit. While difficult to measure, it is expected that this goal will be measured by assessing the extent to which students meet scheduled appointments and their perseverance in achieving goals of mastery and efficiency.

The data which has been collected to date shows that while TICCIT might have the potential of effecting these goals, it has not yet modified student behavior to a marked degree.

For example, like most other instructional techniques, it was found that feelings toward subject matter and the system is influenced as much or more by the instructors assigned to teach the classes as it is by the student's experience on the system. Students have positive feelings when the instructor has positive feelings. More students complete the course when instructors show an interest and provide necessary assistance. In other words, when an instructor assumes the role of an interested and helpful manager of instruction, TICCIT, like many other mediated systems, becomes a valuable tool.

The goals of efficiency, improved learning strategies, and acceptance of learning responsibility are yet to be achieved. This is to be expected, however, because most students have been conditioned in a rigorous teacher controlled learning environment for thirteen or more years before taking courses on TICCIT. Habits are hard to break. It takes considerable adjustment to assume responsibility for one's own learning or to discover what one's most effective learning strategies are.

Achievement of mastery goals seem to be related to achievement of responsibility and strategy goals. An ETS study of the community colleges as well as studies at BYU show that achievement and completion data are comparable with non-TICCIT sections of the courses. For example, TICCIT math completion rates are about 20% at the colleges and 30% at BYU. TICCIT students seem to achieve only slightly higher in most instances than do non-TICCIT students.

I have attempted here to give you a flavor of the results without a lot of statistical data. However, that data is available if anyone would like to look at it.

Contributions to Media Instruction

One of the most significant contributions of TICCIT is a concept of design which I feel goes a long way toward establishing a design science for mediated instruction.

We are all aware of the history in our own field of media's use in instruction. We floundered for years in trying to make television a viable instructional asset. Early efforts to have the medium assist more directly in the instructional process failed and the industry moved to producing supplementary and enrichment materials. More recently there have been some notable examples of television viability as an instructional medium, especially for children. But on the whole, most television is more informational than instructional.

Perhaps this is why I have become so intrigued with the principle of design science growing out of TICCIT and why I have tried to infuse these principles into Instructional Television and other instructional media at BYU.

We have learned, for example, that any mediated message has as its primary goal, one of the following:

1. provide information
2. provide instruction
3. provide motivation
4. provide entertainment
5. provide escape

Instruction requires a different approach than the others. It requires the involvement of three sets of presentation variables. In explaining these variables, I'll try to relate them to TICCIT by way of the learner control panel.

<u>Presentation Form</u>: The first set of variables describe the presentation form. All instructional messages seem to be made up of information and examples (information in the jargonese of some instructional psychologists is called generalities). These can be

presented in either expository (giving) mode or inquisitory (asking) mode. In other words, you can give information or examples, or ask the student to respond to information or examples. These combinations represent four building blocks which can be manipulated to achieve memory, concept, rule, or problem solving objectives. They are:

1. Expository Generalities (EG), i.e., giving information
2. Expository Examples (Eeg), i.e., giving examples
3. Inquisitory Generalities (IG), i.e., asking about information
4. Inquisitory Examples (Ieg), i.e., asking about examples

In TICCIT the Expository Generality is accessed through the RULE key. Pressing it causes a statement of the rule or concept to be displayed. Students get Expository Examples through the EXAMPLE key.

Interdisplay Relationships: The second set of instructional variables is called interdisplay relationships. These include specifications on the number of examples and non-examples which might be required for the student to acquire the objective, the matching of examples and non-examples in terms of divergency of critical attributes, and the difficulty level of the EG, Eeg, or Ieg. The first two are built into the courseware design and TICCIT does not give the learner control over them. Difficulty level, however, is accessed through the HARD or EASY keys.

Mathemagenic Information: The third set of variables is mathemagenic information. This is an esoteric label for the simple concept of instructional help. Cues; attribute isolation through the use of colors, underlining, etc; memory aids; and algorithms or heuristics are accessed through the HELP key.

Each of these instructional variables along with a systematic process of content analysis and objective identification which have emerged from TICCIT are not only intriguing, they are operational. They have been effectively demonstrated in TICCIT, as well as in many Instructional Television products which have been produced at BYU.

Perhaps a fitting summary is a statement by Bunderson made in 1973.

> The extent to which effectiveness goals for students are achieved is very much a function of the learner-controlled courseware concept . . . Rather than being led step-by-step, guided by some all-knowing mathematical algorithm which makes decisions for him, a student is given a command language which allows him to survey freely, establish his own sequence within the constraints set by prerequisites and establish his own learning tactics. Learning tactics are described in terms of the sequence of rules, examples and practice instances a student sees.

(Bunderson, 1973, p. 11).

Thank you.

References

Bunderson, C.V. "The TICCIT Project: Design Strategy For Educational Innovation" Technical Report No. 4, Brigham Young University, 1973.